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QUESTION BANK

Subject with code : Electrical Machines-II **Course & Branch:** B.Tech & EEE

Year & Semester : II & II **Regulations : R18**

UNIT-1

3-PHASE TRANSFORMERS

1. (a) Mention the different tests that are conducted on transformer.[3M]
   (b) Explain the procedure for conducting Sumpner's test along with all precautions to be taken while conducting the test with neat diagram.[7M]

2. A three phase step down transformer is connected to 6600 volts mains and it takes 10A. Calculate the secondary line voltage, line current, and output for the following connections
   (i)Delta –Delta (ii) Star-Star (iii) Delta- Star (iv)Star-Delta [10M]

3. (a) How do you separate hysteresis and eddy current losses of a Transformer.[4M]
   (b) A single phase transformer shows 63W core losses at 40Hz while 110W at 60Hz. Both the tests are performed at same value of maximum flux density in the core. Find hysteresis and eddy current losses at 50Hz frequency.[6M]

4. State and explain the various conditions of parallel operation of three-phase transformers [10M]

5. Discuss various types of 3-phase transformer connections briefly [10M]

6. Explain Scott Connection or T-T Connection of three phase transformers in detail [10M]

7. In a Scott connection, calculate the values of line currents on the 3-phase side if the loads on the 2-phase side are 300kW and 450kW both at 100V and 0.707 p.f(lag) and the 3-phase line voltage is 3,300V. The 300-kW load is on the leading phase on the 2-phase side.
   Neglect Transformer losses. [10M]

8. Explain Open delta operation of 3-phase transformers with neat sketch [10M]

9. A load of 500kVA at 0.8 power factor lagging is to be shared by two three phase transformers A and B of equal ratings. If the equivalent delta impedances as referred to secondary are (2+j6) ohm for A and (2+j5) for B, calculate the load supplied by each transformer. [10M]

10. Determine load shared by each transformer when two transformers are connected in parallel
    (a) With equal voltage ratios[5M]
    (b) With unequal voltage ratios[5M] [10M]

11. a).State merits of three phase transformer over single phase transformers.
    (c) What are the possible of Three Phase Transformer Connections
    (d) Obtain the relation between v-v capacity and Δ-Δ capacity.
    (e) Give the factors affecting the load sharing among the transformers operating in parallel.
    (f) Why a bank of single phase transformers connected in delta is preferred over a three phase delta connected transformer?
    (g) Draw the star-star and delta-star connections of three phase transformers

UNIT-2

3-PHASE INDUCTION MOTORS

1. Describe the constructional details of cage and wound rotor 3-phase induction motor with neat sketches. [10M]
2. A 4-pole, 4-phase induction motor operates from a supply whose frequency is 50Hz. Calculate :
   (i) Speed at which the magnetic field of the stator is rotating
   (ii) Speed of the rotor when the slip is 0.04
   (iii) Frequency of the rotor currents when the slip is 0.03
   (iv) Frequency of the rotor currents at standstill
   (v) Speed of the rotor when the slip is unity [10M]
3. Explain the production of rotating magnetic field and prove that resultant flux is equal to 1.5 times of maximum flux with phasor diagrams [10M]
4. (a) Explain principle of operation of 3-Phase Induction Motor[4M]

   (b) The full load input to 4-pole ,50Hz , three phase induction motor is 50KW running at 1440 rpm. Calculate its full load efficiency , if stator losses are 1000W and frictional losses are 650W.[6M] [10M]

5. (a) Derive Torque equation of 3-phase induction motor.[5M]
   (b) Draw the Torque-Slip Characteristics with neat sketch [5M] [10M]

6. Derive the expression for starting torque, maximum torque and hence obtain the value of maximum torque of a 3-phase induction motor. [10M]

7. Explain the equivalent circuit of 3-phase induction motor with schematic diagram and draw phasor diagram [10M]

8. (a) From the fundamentals, deduce a relationship between rotor power input, rotor power loss and mechanical power developed in case of Induction motor.[5M]

   (b) Explain various losses in an induction motor and draw power flow diagram.[5M]

9. (a) Discuss the points of similarities between a transformer and an induction machine. Explain why induction machine is called a generalized transformer [5M]

(b) The useful torque of a 8-pole ,50Hz, three phase induction motor is 190N-m, the rotor frequency is 1.5Hz. calculate the rotor copper losses if mechanical losses re 700W.

10. A 6-pole, 3-phase 50HZ induction motor is running at full load with a slip of 4%. The rotor is Star connected and its resistance and standstill reactance are 0.25 Ω and 1.5 Ω per phase. The emf between slip rings is 100V. Find the rotor current per phase and power factor assuming the slip rings are Short circuited. [10M]

11. (a) Why an induction motor is called rotating transformer?
(b) Why an induction motor will never run at its synchronous speed?
(c) Define slip of induction motor?
(d)Write an expression for the slip of an induction motor
(e) What are the advantages of 3-phase induction motor?
(f) What are the types of poly phase IM?
(g) A 4 pole 50 Hz 3 phase induction motor has a full load slip of 5 % then calculate the full load speed

UNIT-3

TESTING OF 3-PHASE INDUCTION MOTORS

1. Explain brake test on 3-phase induction motor and list out limitations [10M]

2. Explain how to predetermine the performance of induction motor from no-load and blocked rotor tests. [10M]

3. Explain the procedure to construct circle diagram to find performance characteristics of three phase induction motor. [10M]

4. Explain the following methods of starting of 3-phase IMs
   (i) Star-delta starter[3M]
   (ii) Auto-Transformer starter[3M]
   (iii) Rotor resistance starter[4M] [10M]

5. A 3-phase,400V induction motor gave the following test readings:
   No-load : 400V,1250W,9A
   Blocked rotor test : 150V,4kW,38A
   Draw the circle diagram. If the normal rating is 14.9kW, find from the circle diagram, the full-load value of current, power factor and slip. [10M]

6. A 3-phase,6-pole,50Hz induction motor takes 60A at full-load speed of 940rpm and develops a torque of 150 N-m. The starting current at rated voltage is 300A. What is the starting torque? If a star/delta starter is used, determine the starting torque and starting current. [10M]

7. A 400V, 40 HP, 50Hz, 4 pole delta-connected induction motor gave the following test data:
   No-load test : 400V,20A,1200W
   Blocked-rotor test : 100V,45A,2800W

Draw the circle diagram and determine (a) line current and power factor at rated current
(b) maximum output
(c) maximum torque
(d) full-load efficiency
(e) full-load rotor speed [10M]

8. Explain the pole changing speed control method of 3-phase IM with neat diagram [10M]

9. Explain cascade connection method of speed control of 3-phase IM with neat diagram. [10M]

10. Write short notes on
(a) V/f control of IM[5M]
(b) Injection of emf into the rotor circuit to control speed[5M]

11.(a) Mention any two speed control methods from stator side of Induction motor. 5*2 = 10M

(b) List out different starting methods of induction motors.

(c) What is Cogging in an induction motor?

(d)In what ratio the line current and starting torques are reduced with star-delta starting?
(e) On what factors does the speed of a induction motor depend?
(f) What is meant by crawling?

UNIT-4

SYNCHRONOUS MACHINES-I

1. Explain the constructional features of synchronous generator with neat sketches

2. (a) Derive EMF equation of an alternator

(b) A 3-phase, 16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency and induced emf. Assume full-pitched coil.

3. Explain the principle of operation of synchronous generator and draw its equivalent circuit.

4. (a) Define voltage regulation of synchronous generator
(b) Derive the expression for voltage regulation when synchronous generator is supplying lagging power factor load.

5. Find the no-load phase and line voltage of a star connected 3-phase,6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1Wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot.

6. Explain the procedural steps to find voltage regulation of synchronous generator by Synchronous Impedance Method.

7. Explain the procedural steps to find voltage regulation of synchronous generator bv MMF method.

8. Draw the phasor diagram of Salient Pole Synchronous Machine and explain the concept of direct axis reactance and quadrature axis reactance.

9. Explain the steps involved to find Xd and Xq from Slip Test

10. Find the synchronous impedance and reactance of an alternator in which a given field current produces an armature current of 200A on short-circuit and a generated emf of 50V on open-circuit. The armature resistance is 0.1 ohm. To what induced voltage must be alternator be excited if it is to deliver a load of 100A at a p.f. of 0.8 lagging with a terminal voltage of 200V.
11. (a) Effective resistance
    (c) Leakage reactance
    (c) Armature reactance
    (d) Synchronous Reactance
    (e) Synchronous impedance
    (f) Define load angle and phase angle

UNIT-5

SYNCHRONOUS MACHINES-II

1. a) Define infinite bus bar? Explain synchronization of alternator with infinite bus bar 5M
   b) Necessity of parallel operation of alternators 5M
2. A 5MVA, 10KV, 1500rpm,50HZ alternator runs in parallel with other machines. Its reactance drop is 20%. Find the synchronizing power per unit mechanical degree of displacement and the corresponding torque at
   a) No load b) Full load at 0.8PF lagging 10M
3. What is meant by synchronization of alternators? Discuss any two methods of synchronization of alternator
   10M
4. A 3Ø, 330V, star connected synchronous motor has synchronous reactance of 5Ω/phase. The input to the motor is 1000KW at a normal voltage and a line induced emf of 4000V. calculate the operating Power factor and line current 10M
5. a) Explain the theory of operation of synchronous motor 5M
   b) Compare between synchronous motor and 3Ø induction motor 5M
6. Explain in detail about 'V'curve and 'Λ'curve of a synchronous motor 10M

7. Write short notes on
   a) Synchronous condenser 5M
   b) Hunting and elimination of hunting 5M

8. Briefly discuss about the starting methods of synchronous motor with suitable diagrams 10M

9. a) Explain different torques in synchronous motor 5M

b) Explain the working operation of synchronous induction motor 5M

10. Two 1-Ø alternators are operate in parallel and sharing a load impedance of (3+j4)Ω If the impedances of each machine is (0.2+j2)Ω and emf's are (200+j0)V and (220+j0)volts respectively . Determine

10M a) Terminal voltage b) Current c) Power factor d) Output power of each machine

11. a) List out the conditions for parallel operation of alternators 2M

b) What are the methods used for synchronization of alternators 2M

c) What is meant by synchronous phase modifier 2M

d) Why the synchronous motor is a non self starting 2M

e) What is the purpose of damper winding used in synchronous motor 2M